

Code No: R42024

R10

Set No. 1

IV B.Tech II Semester Supplementary Examinations, July/Aug - 2015

SPECIAL ELECTRICAL MACHINES

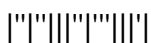
(Electrical and Electronics Engineering)

Time: 3 hours

Max. Marks: 75

**Answer any FIVE Questions
All Questions carry equal marks**

- 1 a) Define the terms *pole arc* and *pole pitch*. [6]
b) What is the minimum stator and rotor pole arcs to achieve self starting of a switched reluctance motor? Discuss. [9]
- 2 a) What is a step angle? Explain. [4]
b) Define stepping rate of a stepper motor. [4]
c) Calculate the stator pole pitch, rotor pole pitch and full step angle of a 12/8 Variable Reluctance stepper motor. [7]
- 3 What is a BLDC motor? Draw the back-emf waveforms and explain the switching logic for a three phase BLDC motors in two-phase switching mode. [15]
- 4 a) What are different drives used in electric traction? Discuss. [7]
b) Explain different types and applications of linear motors. [8]
- 5 a) What are current controllers? Explain hysteresis current control scheme. [8]
b) What is electrically commutated DC motor? List its advantages. [7]
- 6 a) What is the need for closed loop control of electrical machines? Compare between open loop and closed loop control. [7]
b) With a neat diagram, explain the closed loop control of a stepper motor. [8]
- 7 a) Discuss the variation of phase inductance of an SRM with its rotor position. [6]
b) With a neat block diagram, explain the closed loop control of a Switched Reluctance motor. [9]
- 8 a) Give a detailed comparison between AC traction and DC traction. [8]
b) List the main properties of a traction drive. [7]



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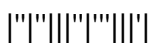
(Electrical and Electronics Engineering)

Time: 3 hours

Max. Marks: 75

**Answer any FIVE Questions
All Questions carry equal marks**

- 1 a) Derive the relationship between *inductance* and *reluctance*. [8]
b) Derive the general expression for torque of a switched reluctance motor. [7]
- 2 a) What are hybrid stepper motors? Give its constructional details. [9]
b) Define the terms *pull-in torque* and *pull-out torque* of a stepper motor. [6]
- 3 a) Differentiate between PMSM and BLDC motors. [6]
b) Prove that the PM BLDC machines have 15% more power density than the PMSM. [9]
- 4 a) Sketch the constructional details of a linear induction motor. [7]
b) Discuss the principle of operation and main applications of linear induction motor. [8]
- 5 a) Give a detailed comparison between permanent magnet DC motors and conventional DC motors. [8]
b) What is hysteresis loop? Discuss its significance. [7]
- 6 What is the need for closed-loop control of stepper motors? Draw the block diagram and explain the closed-loop control of stepper a motor. Also compare closed-loop control with open-loop control. [15]
- 7 With a neat block diagram, discuss the closed loop speed control of a BLDC motor drive. [15]
- 8 a) Explain the advantages of AC traction over DC traction. [7]
b) List and briefly explain different motors used in electric traction. [8]



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Set No. 3

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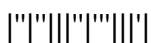
(Electrical and Electronics Engineering)

Time: 3 hours

Max. Marks: 75

**Answer any FIVE Questions
All Questions carry equal marks**

- 1 a) Discuss the basic principle of Switched Reluctance Motors. [8]
b) Draw a three-phase asymmetric power converter used for switched reluctance motor and explain its operation. [7]
- 2 What is the main principle of operation of a stepper motor? Discuss different modes of excitation of stepper motors. Also list their applications. [15]
- 3 a) What is the need for a speed controller? List different speed controllers suitable for BLDC motors. [6]
b) With a neat block diagram, explain the closed loop speed control of a BLDC motor. [9]
- 4 What are linear motors? Discuss in detail the application of linear induction motors for traction. [15]
- 5 a) Sketch the constructional details of a permanent magnet DC motor. [7]
b) Derive the equivalent circuit of a permanent magnet DC motor. [8]
- 6 a) List different components required to implement closed loop control of a stepper motor. [8]
b) Give a detailed comparison between open loop and closed loop systems. [7]
- 7 a) What is the need for rotor position sensing in BLDC motors? Briefly explain. [6]
b) Explain the operation of a three-phase BLDC motor in two-phase conduction mode. [9]
- 8 a) Why induction motors are being used in electric traction? Give their advantages and limitations. [8]
b) Explain the constructional details of a single sided linear induction motor. [7]



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Set No. 4

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SPECIAL ELECTRICAL MACHINES

(Electrical and Electronics Engineering)

Time: 3 hours

Max. Marks: 75

**Answer any FIVE Questions
All Questions carry equal marks**

- 1 a) Draw and explain the torque-speed characteristics of a Switched Reluctance Motor. [7]
b) From fundamentals, derive the basic torque expression of a switched reluctance motor. [8]
- 2 a) Discuss different modes of excitation of stepper motors. [8]
b) Draw and explain the power converter for stepper motors. [7]
- 3 a) Explain the use of hall sensors in the control of BLDC motors. [6]
b) With a neat schematic diagram, explain the speed control of a BLDC motor drive. [9]
- 4 a) List and explain different types of linear motors. [7]
b) Discuss the advantages and disadvantages of linear induction motor. [8]
- 5 a) List the advantages and disadvantages of permanent magnet machines. [7]
b) What is the need for commutator in DC machines? Explain its operation. [8]
- 6 a) What is the need for sensor in the control of stepper motor? Explain. [7]
b) With a neat diagram, explain the open loop control of a stepper motor. [8]
- 7 a) What is the need for closed loop control of electrical machines? [5]
b) Explain the closed loop speed control of a Switched reluctance motor drive. [10]
- 8 Explain the operating principle of a single sided linear induction motor. [15]
Discuss in detail the application of single sided linear induction motors for traction.

